Structures and Methods of Manufacture of Microstructures within a Structure to Selectively Adjust a Response or Responses of Resulting Structures or Portions of Structures to Shock Induced Deformation or Force Loading

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- Materials and Manufacturing
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The U.S. Navy seeks a partner interested in licensing a patented method of designing and manufacturing microstructures within a structure for distributing the load of an impact over a greater surface area without changing the mass or materials of the design.

Material properties of a structure or material can change with a material's grain: size/shape/orientation relative to a force load. Grain boundaries can be described as interfaces where crystals of different orientations meet. These boundary areas contain atoms that have been perturbed from their original lattice sites, dislocations, and impurities that have migrated to the lower energy grain boundary. Grain boundaries disrupt the motion of dislocations through a material. Dislocation propagation is impeded because of the stress field of the grain boundary defect region and the lack of slip planes and slip directions and overall alignment across the boundaries.

NSWC Crane has patented structures and methods of manufacturing utilizing direction of force loading or shock induced deformation of structures including microstructures. Research in this inventive effort discovered, among other things, that the nature of materials or structures under investigation can show behavior that can change under certain types of force loading or high strain rates, such as shocks, on structures design according to embodiments of the invention. Materials that resist motion (failure) under lower strain rates can reverse normal behavior and promote motion under high strain due to behavior of dislocations in a material(s). A dislocation

can be a crystallographic defect, or irregularity, within a crystal structure. A presence of dislocations can strongly influence many properties of materials. For example, dislocations can stop motion and make materials stronger/brittle. However, high densities of organized dislocations can become slip paths for exemplary material subjected to an exemplary force such as shocked material. What was strong becomes ductile. Efforts were made to develop ways of utilizing direction of shock induced deformation including in design of shape charges as well as other structures.

People:

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